



Atty. Dkt. No. 085874-0389

#3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Russ BOWN
Title: MULTI-FUNCTIONAL VIBRO-
ACOUSTIC DEVICE
Appl. No.: 10/022,837
Filing Date: 12/20/2001
Examiner: Unassigned
Art Unit: 2632

CLAIM FOR CONVENTION PRIORITY

Commissioner for Patents
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed.

In support of this claim, filed herewith is a certified copy of said original foreign application:

- GREAT BRITAIN Patent Application No. 0031246.2 filed 12/20/2000.

Respectfully submitted,

Date FEB 01 2002

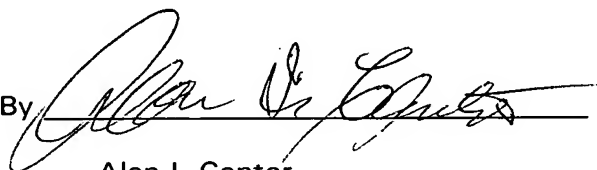
FOLEY & LARDNER
Customer Number: 22428



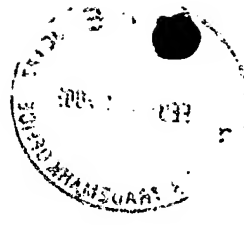
22428

PATENT TRADEMARK OFFICE

Telephone: (202) 672-5570
Facsimile: (202) 672-5399

By 

Alan I. Cantor
Attorney for Applicant
Registration No. 28,163



THIS PAGE BLANK (USPTO)



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

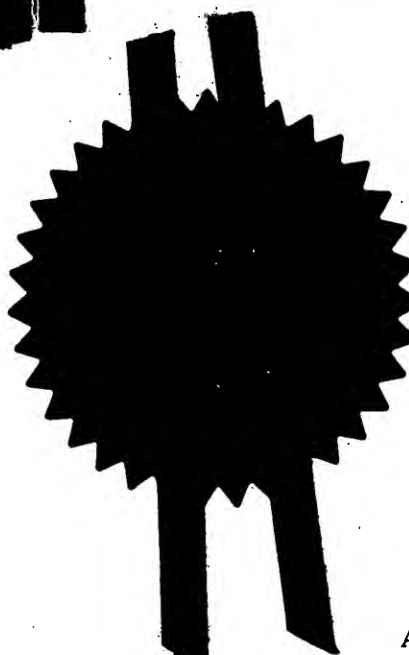
In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

CERTIFIED COPY OF PRIORITY DOCUMENT

Signed

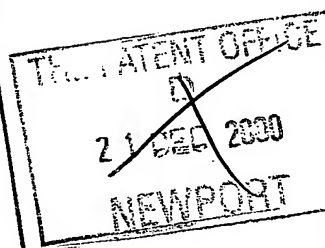
Dated 13 December 2001



THIS PAGE BLANK (USPTO)



The
**Patent
Office**



The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form).

19 DEC 2000
RULE 97
NEWPORT

1. Your Reference

P.6300.GBA 1

2. Patent app
(The Patent O

0031246.2

19 DEC 2000

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

NEW TRANSDUCERS LIMITED
IXWORTH HOUSE
37 IXWORTH PLACE
LONDON
SW3 3QH

Patents ADP number (*if you know it*)

If the applicant is a corporate body, give the country/state of its incorporation

G.B.

7283476002

4. Title of the invention

Vibro-Acoustic/Human Machine Interface Device

5. Name of your agent (*if you have one*)

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

MAGUIRE BOSS
5 Crown Street
St. Ives
Cambridgeshire
PE27 5EB

Patents ADP number (*if you know it*)

07188725001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (*if you know it*) the or each application number

Country

Priority application number
(*if you know it*)

Date of filing
(*day/month/year*)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(*day/month/year*)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer 'Yes' if:*

YES

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.)
See note (d)

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 11

Claims(s)

Abstract

Drawing(s) 1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

Request for preliminary examination and search (*Patents Form 9/77*)

Request for substantive examination (*Patents Form 10/77*)

Any other documents
(please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Date 19/12/2000

MAGUIRE BOSS

12. Name and daytime telephone number of person to contact in the United Kingdom

PETER MAGUIRE

Tel: 01480 301588

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505.

b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.

e) Once you have filled in the form you must remember to sign and date it.

f) For details of the fee and ways to pay please contact the Patent Office.

5

Acoustic Device

10 This invention relates to apparatus incorporating an acoustic device and additional functionality.

 Bending wave or distributed mode loudspeakers (DMK) are described in WO97/09842 and other documents in the name New Transducers Ltd. Some loudspeakers are used in
15 applications where the loudspeaker element has additional functionality, such as a ceiling tile, a projection screen or as a frame for hanging artwork.

 According to the invention there is provided an apparatus comprising a bending wave panel and a transducer
20 attached to the bending wave panel for coupling to the bending waves in the panel, wherein the surface of the panel is used to supply a plurality of additional functions.

 The apparatus according to the invention may
25 accordingly reduce the surface area required to provide a plurality of functions.

 Such multiple combinations would be more difficult using conventional loudspeakers - it is not possible to mount keypads, displays etc on the cone of a conventional

loudspeaker without interfering with its function.

The additional functionality may include a touch keyboard on its surface and means for providing force-feedback (haptics capability). This allows the keyboard
5 function to occupy the same surface area as the loudspeaker. This reduction in surface area may be of particular benefit in portable device applications, such as mobile 'phones, videophones or electronic organisers.

Touch related functionality can be included. For
10 example, the sensation of a button 'click' could be achieved by playing a transient "spike" function through the exterior surface. This may eliminate the need for a conventional keypad. The tone may be acoustic, a click, a tone or a voice or specific tones may be assigned to
15 specific data entered on the keyboard. Acoustic and tactile feedback may be provided in combination. Alternatively, regions may be locally heated to provide tactile feedback.

The additional functionality may include the use of
20 the bending wave panel as a display. The panel may be transparent and a visual display device may be mounted behind the panel. Alternatively, the panel itself may have a display capability, for example by using light emitting polymers or pigments.

25 The combination of haptics/touch sensitive functionality and a display may be used to provide a touch sensitive display.

Other functions may be provided. The panel may

function as a microphone and/or loudspeaker. The panel may function as a ringer loudspeaker, and/or vibration transducer for mobile 'phones, pagers etc.

An embedded stills or video camera may be provided.

5 Chromatic characteristics may be included, such as anti-glare or mirrored finishes. Active chromatics may be provided, such as photo-chromatics or thermo-chromatics.

The transducer may excite bending waves on the panel to cause it to emit sound at a variety of volumes, suitable for use as an earpiece of, for example, a
10 telephone handset, as a loudspeaker or both. The volume of sound output may be adjusted depending on the application. Due to the multi-functional nature of the speaker itself, the range of functional combinations is
15 further increased. For example the demonstrable capacity to produce a bending wave and transducer drive unit capable of being used in privacy mode (earpiece) as well as a hands-free conference mode removes the need for a perforated screen in between the drive unit and the
20 listener's ear, as required using conventional loudspeakers.

A specific embodiment of the invention will now be described, purely by way of example, with reference to the accompanying drawing which shows a PDA according to the
25 invention.

The drawing shows a PDA 1 having a casing 3 and a panel 5. The panel is a bending wave panel and functions as a microphone due to a microphone transducer 7 fixed to

the panel. As an alternative, a unitary small microphone with a local aperture could be used. The panel is transparent to allow a display 9 to be viewed through the panel.

5 The panel also functions as a keyboard and has individual keys 11 marked on its surface. Tactile feedback is provided by a tactile exciter 13 mounted on the panel to provide pulses to the panel when a key is depressed. An earphone/speaker exciter 15 is provided to
10 allow the panel to function as a loudspeaker. Depending on the volume, the PDA may be held to the user's ear or be used as a loudspeaker telephone, sitting, for example, on a desk.

 The speaker exciter may be energised in the body
15 perceived band around 80Hz to provide silent signalling of a call. Increased efficiency will result if the exciter is chosen to be resonant at this frequency. For an NXT exciter the magnet mass and suspension compliance may be chosen to this end.

20 A mobile communications aerial 17 and associated conventional mobile telephony circuitry (not shown) allows the device to function as a mobile telephone or to send emails or messages.

 The surface of the panel may be of appropriate
25 thinness and moderate mechanical impedance to be set into bending vibration for several purposes, using the transparent area for display.

 The invention may have application in the following

fields: Mobile 'phones, pagers, communicators, Multimedia devices (TV,PC,DVD players etc), Laptops, PDAs, portable music, white or brown goods, cameras/video cameras, toys, games, automotive, transportation, telematic applications. 5 such as navigation or entertainment, control surfaces, product housings, accessories, video-phones/video conferencing, TV/3D-TC/Virtual reality or augmented reality devices, architectural or building surfaces, medical devices, furniture, industrial machinery, office 10 equipment, clothing and badges, credit cards, smart cards, novelty and greetings products, art or defence.

As a further example, a combined media player may be provided, having mono, stereo or multi-channel sound. The player may function as some or all of a computer, 15 communicator, web TV, videophone, camcorder, dictaphone, organiser, augmented reality window, GPS/navigator, to or game. A single surface could have a touch sensitive display, a sound source (ear-piece, hands-free loudspeaker, ringer and bleeper), haptics capability, 20 microphone, embedded camera and/or video camera. The device could be supplemented by viewing apparatus for 3-D image perception or additional sound sources for reproducing extra audio channels, e.g. rear channels and a sub-woofer as typically installed in home cinema and other 25 surround sound applications.

From another aspect this invention relates to the amalgamation of a vibro-acoustic device with other sensory features and functionality which results in significant

benefits for the manufacture and use of Human Machine Interfaces (HMI). The concept allows the simultaneous integration of a wide range of acoustic and other sensory functions into what will be referred to as an "Hyper-
5 Functional Surface". The term is coined as an attempt to convey the increased number of functional synergies made possible within a single component assembly.

Originality is claimed for extending the perception of
10 acoustic radiating surfaces to include other sensory functions beyond simple touch-sensitivity. The principle can be applied equally well to both bending wave loudspeakers (eg the Distributed Mode Loudspeaker - DML) as well as pistonic acoustic radiators.

15

Previously, perceptions of DML technology have included the use of both opaque and transparent loudspeaker panels which may incorporate a touch-sensitive capability. The first extension to this perception is the inclusion of a
20 force feedback facility into the same surface. Combining this 'haptics' functionality with a transparent, touch-sensitive DML results in a single device which can be used to view information, hear acoustic signals (messages, bleeps, clicks etc) and feel 'simulated' button clicks
25 through one's finger tips. Alternatively, 'passive' force feedback may also be achieved by utilising non-linear panel mounts, which again results in the sensation of a button-click when depressing the exterior of the Hyper-

Functional Surface. In certain applications (such as hand-held devices), one benefit to adopting Hyper-Functional Surfaces could be to completely eliminate the need for separate keypads.

5

However, it should be noted that the functional mix described above is just one example of the wide range of 'component synergies' made possible by the principle of Hyper-Functional Surface. The invention therefore

10

'unlocks' a large number a new device options which can be expressed as the total number of combinations of each of the separate sensory functions in conjunction with any or all of the other stated functions. Such HMI functions may include: -

15

display surfaces (transparent window or opaque images)
multi-functional loudspeaker (receiver / hands-free etc)
touch sensitivity

force feedback (haptics touch feature)

20

embedded heating / cooling elements

passive chromatic finishes - eg mirrored etc

active chromatic finishes (eg photo or thermo chromatics)

surface textures and variable surface contours

embedded camera(s) - ie, video or stills

25

embedded single microphone sensors or arrays

a variety of other sensors, eg chemical composition, electrical sensors, light-meters etc etc

In the case where an Hyper-Functional Surface (HFS) is
5 behaving as a transparent display window, the window would
be mounted in front of a conventional display surface such
as an LCD panel etc. However if light-emitting surface
finishes are applied (eg light-emitting polymers) the HFS
may also incorporate the display function itself, hence
10 further reducing the number of components needed for a
versatile HMI device.

In certain applications (eg communications and computing),
future product bulk is tending towards zero (ie
15 approximately zero internal volume required for
components). The 'usefulness metric' of such a device
therefore becomes expressed in terms of "functionality per
unit surface area". The hyper-functional surface
anticipates this trend and offers the designer a way to
20 maximise the range of sensory options for any given
surface.

A specific embodiment of the invention will now be
described, ~~purely~~ by way of example, with reference to the
25 accompanying drawing which shows a Smart-Phone / PDA
according to the invention.

The drawing shows a Smart-Phone / PDA fig.1 having a casing 1 and a touch-sensitive panel 2 which behaves as an HFS. The panel is made from a transparent material allowing an LCD display (mounted behind the HFS) to be viewed. The panel also functions as the keypad or keyboard (querty etc) and has individual keys 3 which appear on the display when the device is operating in these modes.

10 The panel is of the appropriate thickness and moderate mechanical impedance to be set into bending vibration for several vibro-acoustic purposes. Haptics feedback is provided by tactile actuators 4 mounted on the panel to provide pulses to the panel when a key is depressed. The
15 haptics function gives the sensation of simulated key depressions or other tactile feedback eliminating the need for a separate key-pad or keyboard.

The same actuators also double-up as vibration transducers turning the panel into a multi-mode
20 loudspeaker (telephone ear-piece / hands-free speaker / ringer). The speaker exciter may be energised in the body perceived band around 80Hz to provide silent signalling of a call.

25

Twin microphone transducers 5 embedded in the panel allow sound capture and localisation for sound reproduction when in conference call or video mode. Images

are captured using the embedded digital camera(s) 6.

An embedded mobile communications aerial and associated conventional mobile telephony circuitry (not shown) allows
5 the device to function as a mobile telephone or to send and receive messages or video material.

Taking this application to an extreme it could within its apparently simple construction perform the function of
10 many distinct devices which all use the HFS as the user's main interface medium.

Such functionality could simultaneously include a combined media player having mono, stereo or multi-channel sound.
15 It may function as a computer, communicator, web TV, video-phone, camcorder, dictaphone, organiser, augmented reality window, GPS/navigator, game and wearable fashion accessory. The device could be supplemented by viewing apparatus for 3-D image perception or additional sound
20 sources for reproducing extra audio channels, e.g. rear channels and sub-woofer.

By considering this example it becomes apparent that hyper-functional surfaces could have relevance to
25 applications in each of the following fields: -

Control surfaces in all consumer / industrial applications (including displays or product housings)

Telephones - mobile, fixed, intercoms, pagers, videophones

Multimedia, Laptops, PDAs etc

Portable music or video players & recorders / Dictaphones

Toys & games

5 Cameras / video cameras

TV / 3D-TV / Virtual & augmented reality / Video-on-Demand

White goods / Brown goods

Architecture / building, furniture, office equipment

Medical devices

10 Clothing / badges / labelling

Novelty and greetings products

Credit cards, smart cards

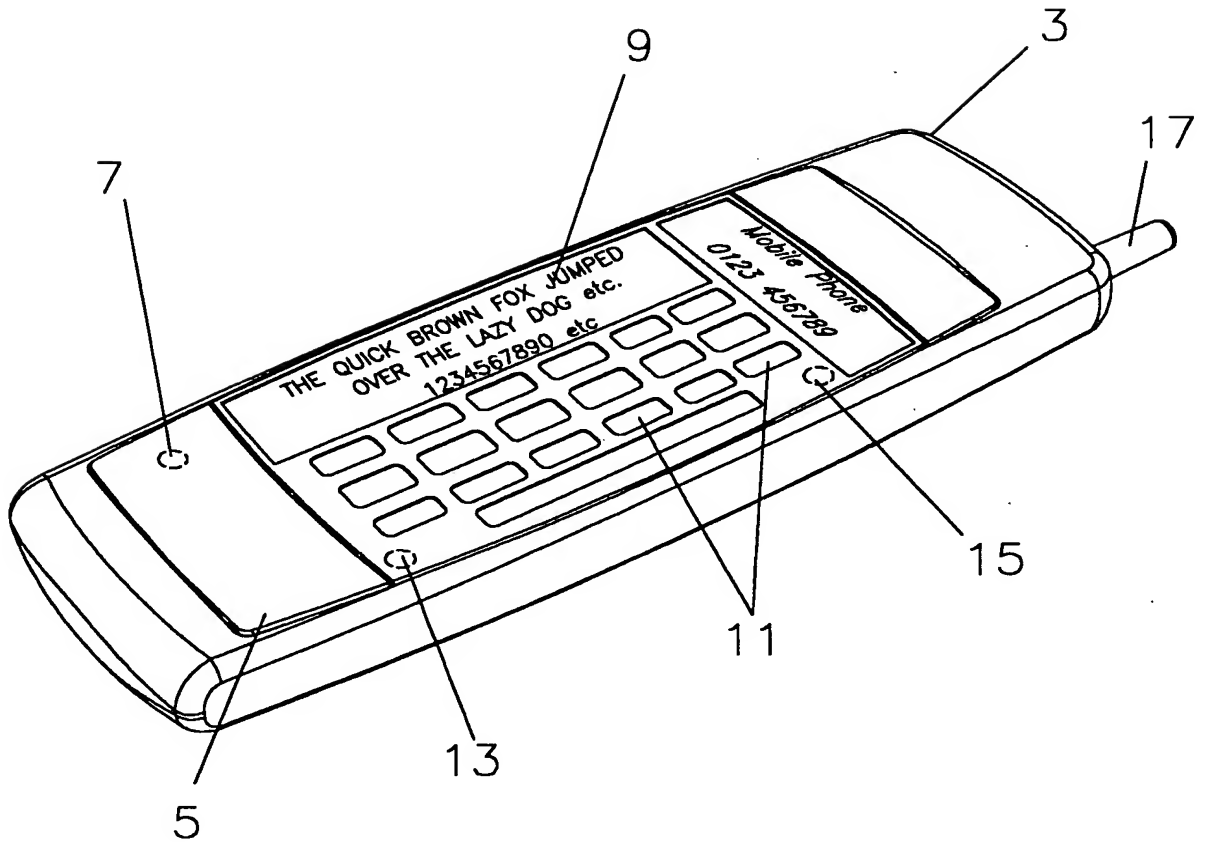
Art

Defence

15



THIS PAGE BLANK (USPTO)



Inventor: Russ BOWN
Serial No. 10/022, 837
FOLEY & LARDNER
3000 K Street, N.W., Suite 500
Washington, D.C. 20007-5109
Docket No: 085874-0389
Filed: Dec. 29, 2001

THIS PAGE BLANK (USPTO)